

a fourth electrode electrically connected to the voltage source via a second resistor and to the voltage sensor,

phase change memory material disposed in electrical contact with the third and fourth electrodes, and

5 a third on/off switch included in the electrical connection between the third electrode and the current source or the electrical connection between the fourth electrode and the second resistor. *CD 3/25/05*

4. The array of claim 3, wherein a resistivity of the phase change memory  
10 material of one of the plurality of reference memory cells is different from that of another one of the plurality of reference memory cells.

5. The array of claim 1, wherein the current source further selectively supplies a  
programming electrical current that is greater than the read electrical current, and is sufficient  
15 in amplitude and duration to alter a resistivity of the phase change material of the memory cells when the programming electrical current flows therethrough.

6. The array of claim 5, wherein for each of the memory cells, one of the first  
and second electrodes has a resistivity that is higher than that of the other of the first and  
20 second electrodes so that the programming electrical current flowing therethrough generates heat therein to heat the phase change memory material.

7. The array of claim 5, wherein each of the memory cells further comprises:  
insulation material having a hole formed therein;  
25 spacer material disposed in the hole and having a surface that defines an opening having a width that narrows along a depth of the opening, wherein the memory material is disposed in the opening and extends along the spacer material surface, and wherein one of the first and second electrodes is disposed in the opening and on the volume of memory material;